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FOOD PRESERVATIVES.

By Henry Leffmann.

In the active prosecutions that have been undertaken within the past few years for the suppression of food adulteration, a conspicuous feature has been the antagonism to some preservatives. The preservation of food by artificial means is a necessity of civilized life. Some methods have been used from a very early period. Among these are cooking, drying, smoking, salting and pickling. Of less importance, because of limited applicability, are freezing, spicing and sugaring. Mankind resorted to all these methods long before the chemistry and physics of the processes of fermentation, putrefaction and decay were known, and the date and manner of discovery of the older methods are unknown to us. Indeed, the history of the development of exact knowledge in this respect is within the memory of many living persons.

The progress of organic chemistry has resulted in the discovery of several substances of marked antiseptic quality and comparatively little toxicity. The best-known examples are formaldehyde, salicylic acid, benzoic acid and the naphthols. One inorganic substance, boric acid, has also been found suitable for antiseptic purposes. These substances are eminently adapted, from the manufacturing point of view, to the preservation of food. They are cheap, and, in the amount needed, give no color, odor or appreciable taste to the material. Each substance has its preferable applications. Thus boric acid (including borates) is adapted to the preservation of meat and milk; salicylic and benzoic acids to fermentable articles, such as fruit juices and jellies.

When the authorities charged with the active prosecution of food-adulteration began their work some years ago, in different parts of the United States, they found some of the above-mentioned preservatives in extensive and comparatively long-established use. The question as to wholesomeness at once arose. It was met by different authorities, as might be expected, in different ways. Some have assumed that all preservatives of ancient origin are safe, and all of modern origin are unsafe. Acting on this decision, some officials have established the broad forbidding of all preservatives except salt, vinegar and wood-smoke; others have permitted limited use of boric and benzoic acids and their sodium salts. Salicylic acid has been generally prohibited.

It cannot be said that these distinctions in permission are founded upon a scientific basis. The experimental data are not extensive, and are somewhat one-sided; the investigations have been made with the modern, or, as they have sometimes been called, chemical preservatives. If we accept freely the published results, we can say, I think, merely that a limited amount of disturbance of function may be attributed to the most used of the modern antiseptics.

The question, in my opinion, cannot be considered as placed on a scientific basis until all forms of preserved food have been studied carefully in comparison. It is probable that all forms of preserved food are less wholesome than fresh. Even the cooking of proteid-foods diminishes their digestibility. Drying, salting, smoking and pickling have probably still more unfavorable effects. Experiences among those who make long journeys away from the comforts of civilization, who must rely on food preserved in any manner, show amply that fresh materials have some special nutritive quality that is not long retained. This fact is abundantly exemplified in the history of navigation, and in recent experience of Alaskan pioneers.

The action of certain authorities in placing the older preservatives on a permissible list and the newer ones on a forbidden list is purely arbitrary. It has been, in most cases, done without scientific bases; indeed, in some respects, in defiance of the known data. Certainly, with regard to salicylic acid, Kolbe's long experiment on himself should receive consideration. It is true that experts can be easily secured who will express opinions unfavorable to a given article, but this counts for nothing; experts can be found ready to give opinions either way.

In this State convictions have been obtained in several cases upon the principle that if it can be shown that the preservative is poisonous in any dose, it is to be considered a poison absolutely, and its use contravenes the law. It seems to me that this sets at nought the whole science of pharmacodynamics. The question whether or not a substance is a poison is one of dose. No substance is absolutely a poison. If we adopt the interpretation of a term that is advocated by some authorities, many articles of food will come into the category of injurious substances and their use could be forbidden. Vanillin, caffeine, citric acid are all capable of producing disturbances of function when taken in large amount or continuously, yet as taken in common beverages they are generally regarded as wholesome. Even the old-established preservatives would go down under this system. Acetic acid, upon which the preservative action of vinegar depends, is one of the most corrosive substances known; wood-smoke owes its preservative quality to creosote and its analogues, also highly corrosive. The truth is, the definition of a poison must involve the questions of dose and manner of administration. Hydrogen sulphide, for instance, is actively toxic in one form of administration and not so in another.

We have lately had in this city an interesting instance of the peculiarities of expert testimony, when it depends on mere opinions rather than inferences for actual experiment. The food authorities of Pennsylvania not long ago forbade the sale of vegetable articles colored with copper, because this metal was regarded as dangerous. Dr. H. W. Wiley, in a public lecture last winter, deprecated the sale of such articles, although not definitely declaring the metal poisonous. Since that time experts in another bureau of the Department of Agriculture have been active in declaring that copper is quite harmless, and several Philadelphia physicians have been supporting this view. One set of experts tells us that copper cannot be allowed in appreciable amounts in any food article; another set, equally eminent and equally positive, tells us that it is entirely harmless in drinking water. Who shall decide when doctors disagree?

What data are there to show that salt is entirely harmless in food? What proof have we that sodium benzoate is more objectionable than the ingredients of wood-smoke?

HOW FOOD PRESERVATIVES AFFECT THE PUBLIC HEALTH.

By R. G. Eccles.

Every intelligent man is an advocate of pure-food laws and of their enforcement. To advocate the use of preservatives in food is to advocate in behalf of pure food. Perishable foods subjected to delay in other than cold-storage transportation, or delay in packing in the absence of cold storage, cannot reach the consumer in a pure state if preservatives are not used. Food may reach the consumer relatively pure and not remain so until consumed. Scarcely a month passes that somebody is not reported killed with impure food and dozens have been seriously injured by it, and always because that food did not contain preservatives. To stop this incessant slaughter of innocent people is the object of advocates of preservatives. They want to see the market supplied with food that will not kill and maim. They are confident that for every reported case of virulent ptomaine poisoning there are a hundred mild cases never heard from. Meat, fish, beans, catsups and sausages, with many other kinds of foods, are constant carriers of impurities which sacrifice human lives and cause continuous suffering to multitudes. Such impure food looks well, tastes all right, smells as if fresh, and in every way appears to be good, but it kills. It is in a condition of incipient decay, and not in that extreme form of decay which is detectable. The spores of deadly microbes remain harmless until a little warmth nurses them into vitality. The heat we call comfortable for a room is all that is needed to develop their danger. Let there be no ice in the house, or let the maid leave the food out of the refrigerator for a short time, and human lives are sacrificed.

Delays in reaching cold storage, or in reaching the packers, when no ice is available, permits a first crop of spores to grow and be sown over the food. Delays in putting left-over provisions into the kitchen refrigerator develop the poisons along with a second crop and whole families are maimed or killed. If carriers of perishable foods, instead of being forbidden by law to use preservatives on such foods, when they are delayed and cannot be hurried into a refrigerator, were compelled to use these agents *before* decay had a chance to start, there would probably be fewer deaths from ptomaine

poisoning. Unless the public demanded more, none but delayed goods would require the use of preservatives, and they would be added *before* the food had had a chance to begin its decay. In consequence of such treatment it would reach the market in a perfectly fresh and safe condition. Such food could be marketed as preserved food and left to the law of the survival of the fittest to settle its fate. Legislation that forbids this sort of saving of food threatened with decay puts a premium on deception and encourages packers and others to put upon the market goods that appear all right, but that are laden with death and suffering. They throw away the least deadly, because no one will buy it, but they sell the most deadly, because they know that even food experts cannot tell but that it is all right. Somebody knew that it was delayed away from refrigeration, and could have saved its slaughter of human beings but for vicious law.

"But," you ask, "are not preservatives harmful?" What if they are? No living being dare assert that they ever did the harm that decayed food has done. Because they might do a little injury, is that any reason why they should not be permitted to save hundreds of lives? What injury have our most frequently-used preservatives ever done? Can you find a single recorded case of a human being having been injured by preserved foods? No one has yet succeeded in finding such a case. Salicylic, benzoic and boric acids, with their salts, have been in use for over twenty years, and no one can point to the record of a single person having been maimed or killed by any article of food containing them. Thousands have been killed and thousands more tortured through having used food that should have been, but was not, protected by these chemicals. Has it ever occurred to you to ask the grounds upon which the opposition to preservatives is maintained? Do you know that in all the swearing in our courts by witnesses against preservatives, it is done on purely theoretic grounds? Do you know that the theory is an old one of a generation ago, that no living authority now dares to maintain? Let me quote a statement from the words of a man who is an American leader in this war against preservatives: "There is no preservative which paralyzes the ferments which create decay that does not at the same time paralyze *to the same extent* the ferments that produce digestion. The very fact that any substance preserves food from decay shows that it is not fit to

enter the stomach." (Bull. 100, Ky. Agr. Exp. Sta., p. 101.) According to that, and it is from the highest authority of the opposition, the better a preservative preserves, the more dangerous it is to human beings. On the strength of this assumption they fight preservatives, call them poisons, and denounce them as injurious to health. They have no experimental evidence as yet of the truth of such a claim, but are trying now to get it. The theory, in their case, preceded their experiments. All men of science know what this means.

I wish to particularly divert your attention to the use of the word "ferment" by the authority I have quoted. He uses the word in two distinct and *unlike* meanings. On this blunder he draws his conclusion. The ferment of decay and the ferment of digestion are related to each other just as much as the sugar of lead is related to the sugar of milk, or the oil of vitriol is related to the oil of cottonseed. Indeed, the difference is far greater in the ferment case than in either of the others. Our ignorant fathers confounded the living germs of putrefaction with the chemical substances we call enzymes, just as they confounded sulphuric acid with oils and acetate of lead with sugars. No one is now so ignorant as to reason that what is true of oil of vitriol must be true of oil of peanuts, or what is true of sugar of lead must be true of sugar of milk. The State and national leaders of the opposition to modern preservatives do not blush over confounding ferments with enzymes and drawing conclusions from such confusion. They would think a country rustic should blush for his ignorance if he should reason that because oil is an excellent application for the hair, he should proceed on the strength of such logic to apply oil of vitriol to his hair. They talk glibly of *paralyzing* the ferments of digestion, which are *dead chemical substances*, because they may be permitted to speak of paralyzing living germs. They do not hesitate to draw the conclusion that this paralyzing (?) of enzymes, unfounded as it is, is proof that our bodies are injured, *i. e.*, poisoned, by preservatives. Let us test such logic: "Hydrochloric acid will paralyze the ferments that create decay. Hydrochloric acid must, then, *to the same extent* paralyze pepsin, the ferment that produces digestion. The very fact that hydrochloric acid preserves food from decay shows that it is not fit to enter the stomach." Could mortal man reason worse than this? I need not stop to tell intelligent pharmacists that if

hydrochloric acid paralyzed (?) the ferments of digestion, and if it did not enter our stomachs, we would all soon be dead men. If such logic was sound, there would not be a living man or vertebrate animal on this earth. Yet, this is the kind of reasoning that has led to the swearing in court that salicylic acid is dangerous to health and a poison. It has had men fined and has wrecked many a substantial and useful industry in this and other countries. It is threatening you pharmacists to-day with fines and imprisonments. Salicylic acid has been chosen as the special target of attack because, as the author of the above reasoning elsewhere says, "on account of its cheapness and activity it may be called the universal preservative" (lecture on "Living a Hundred Years," *Chicago Record*, verbatim report, February 28, 1901). Its methyl ester is found in hundreds of plants from the most diverse botanic orders. Most fruits contain it. Nature has thus put it into our food. In this respect it is like benzoic acid. I defy any one of them, if he likewise dares to claim that vinegar is *not* a poison, to put the matter to the test of a public experiment with me. If vinegar is a poison, then the Judge's ruling makes it a crime for any person to add vinegar to any kind of food in this State. Will the commissioner be consistent and just? Will he punish with fines every person who is selling pickles or mustard, catsup or relishes, because they contain vinegar? The acid of vinegar in its pure state is, according to the best authorities in therapeutics, *eight times stronger* than salicylic acid in its pure state. Is it just to punish the men who use the weaker substance and permit those who use the stronger to escape unscathed? If the commissioner doubts the testimony of works on therapeutics as regards the comparative toxicity of these two substances, will he test the matter experimentally? I will begin with a grain of salicylic acid at a dose. After I have taken it, let him then take a grain of the *pure* acid of vinegar. Let us each day increase our doses by an extra grain, and continue till one or other of us cries "enough!" In this way the substances can tell their own tale. If salicylic acid is a poison, then the acid of grapes, the acid of lemons, the acid of all kinds of fruits, the acid of sauer kraut, and the acid of vinegar *must* one and all be called poisons. They are all pronounced stronger than salicylic acid; not by one standard work on therapeutics, but by *every such book* published in the world that I have been able to consult.

In their strongest condition, boric, benzoic and salicylic acids are *much weaker* than multitudes of substances used daily in our foods when they are concentrated. Take the essences; many of them are far more potent. Take the spices; they, too, are more potent. Take mustard; it is immensely more potent. Take the phenols of smoked meats and fish; they are much more potent. Take the flavors of butter, of all kinds of fruits, of cheese, and some of them are so vastly more toxic that there could be no comparison between them. Apply the Judge's charge to his jury to all of these and where would we be? No one dare sell butter, cheese, mustard, pepper, apples, pears, grapes, bananas, pies, cakes, ice cream, candies, any fruit, any bread containing fruit, any article containing a flavoring ingredient, etc. In fact, he would close the market upon nearly everything that civilized man wants to eat. What a blessing it is that some men are not consistent. Just the same, however, the Judge has established a precedent that makes every dealer in almost every kind of pastry, confectionery, dairy products and fruits, violators of the laws of the State of Pennsylvania.

Prior to the census of 1900 your commissioners allowed you freedom. As a result, the vital statistics of that census gave your State a favorable showing. In Minnesota, Michigan, Wisconsin, Illinois and the Dakotas no such freedom was permitted. These States forbade and punished all who used such preservatives. If you care to take the trouble to look up the statistics of the results, you can find them on page ccxxvi of Vol. III, Part I, Twelfth Census of the United States. On that page you will find a table giving the death rates in all parts of the United States from diseases of the digestive system. As this kind of diseases comes from poisonous germs in food and drink, you can see how applicable the study of such a table is to this discussion. There you will learn that in grand groups 19 and 16 the death rates were *far higher* than in any of the remaining groups. On pages cviii and cix it will be seen that these grand divisions are made up of the States where the commissioner's present methods were tried before the census and are still being blindly pursued. The region that gives the lowest rate is a region of factories where the dinner pail is the ice-box, and where without preservatives their food could not keep till consumed. The major-

ity of the people there are too poor to afford an abundance of ice, and must buy considerable food that will keep without it. If the commissioner's methods continue till the next census is taken, I will watch with extreme interest to see if the results agree with those of the last.

THE THEORY OF INDICATORS AND ITS BEARING ON THE ANALYSIS OF PHYSIOLOGICAL SOLUTIONS BY MEANS OF VOLUMETRIC METHODS.

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(*Continued from p. 467.*)

VI. USE OF INDICATORS IN TITRATION OF NORMAL STOMACH CONTENTS.

From the results recorded above, bearing in mind the fact that the end point of an indicator is dependent entirely upon the state of equilibrium of the substances present in the solution, it must be concluded that the differences observed between the different types of indicators in conjunction with normal stomach contents is attributable, in the first place, to the nature and quantity of nitrogenous bodies present. In other words, whilst the absolute end point obtained with any given indicator may be a function of the acid or acids present, the range from the lowest end point, phloroglucinvanillin drops, for example, to the highest, phenolphthalein or Porrier's blue, for example, is almost entirely dependent, in the first place, upon the amount of nitrogenous bodies present, and in the second place upon the extent to which the bodies in question have been hydrolyzed with the liberation of basic groups capable of combining with hydrochloric or other acids to form weak salts. Each individual period between indicators may be attributed more or less to the influence of varying types of amine groups; from those which in virtue of their union with carbon, to which only hydrogen is bound, may be looked upon as extremely positive, to those lying in close proximity or directly attached to a CO group, which possess, according to their position in the molecule, either very slight positive or even neutral to negative characteristics. It cannot

be said that any given period is a direct function of any given type of combining nitrogenous group, for the end points of certain indicators are more delicate than those of others. If stomach contents were purely a mixture of hydrochloric acid with nitrogenous bodies possessed of basic affinities varying in strength from that of ammonia to that of the NH_2 group in urea, then the final end point should be a gauge of the total hydrochloric acid and the difference between the final and intermediate end points should be dependent upon the quantity and degree of hydrolysis of the nitrogenous products in question. But this is not the case. Phosphates, organic acids and other substances present in small quantities interfere to an appreciable extent with results and must be allowed for.

In the course of the last two years some 250 stomach contents have been examined after a variety of test meals, that of Ewald being employed by preference. In certain cases estimations were carried out on unfiltered materials, but generally they were first filtered and then titrated with a series of indicators. Total chlorine was estimated by adding an excess of alkali, ashing and determining volumetrically with silver nitrate and potassium sulpho-cyanate; chlorine present as salts estimated by ashing directly, igniting and determining volumetrically, the difference representing hydrochloric acid free and combined and any ammonium chloride that may have been present in the original stomach contents. The phosphates were estimated volumetrically by the method described in a previous publication, the neutralized stomach contents being evaporated, ashed, ignited, ammonia removed by boiling with alkali and carbonic acid by boiling with acid, the difference between the alizarin and phenolphthalein end points affording an accurate estimate of the effect attributable to phosphates. Total nitrogen was determined by the Kjeldahl process, as was that present in the phosphotungstic filtrate obtained on precipitating 10 c.c. of stomach contents with 10 c.c. of 20 per cent. solution of phosphotungstic acid containing 2 per cent. of sulphuric acid. Lactic and other organic acids when present in sufficient quantities to produce an appreciable effect were estimated separately.

In the large majority of normal cases the phenolphthalein end point, after allowing for the influence of phosphates, was found to afford a fairly accurate estimate of the total available hydrochloric acid in the stomach contents; that is to say, hydrochloric acid, either

free or combined with proteids.[1] In a series of abnormal cases, the majority of which were cancer, this was not found to be the case, large differences amounting to as much as 6 and 8 c.c. for 10 c.c. of stomach contents being accounted for only partially by the lactic acid separately estimated. In certain of these cases one is forced to the conclusion that some secondary decomposition of proteids has led to the liberation of carboxylic groups, such as that present in aspartic acid, for example, groups which, as was shown in Section IV, are capable of producing an effect upon alizarin or phenolphthalein; also the weaker type, similar to that present in asparagin, glycocol, leucin and tyrosin, which are capable of exerting an influence on Porrier's blue. This effect of liberated carboxylic groups may be recognized in another manner. If artificial peptic

TABLE III.

Case.	1	2	3	4	5	6	7	8	9	10	11	12
Free and combined HCl	7·7	11·1	9·0	9·4	8·0	5·6	7·1	3·6	2·6	4·1	6·6	6·4
Total phosphates . .	Nil	Nil	1·5	·6	·3	·4	·8	·8	·4	·4	·2	·6
Sum	7·7	11·1	10·5	10·0	8·3	6·0	7·9	4·4	3·0	4·5	6·8	7·0
Phenolphthalein end-point	7·6	10·9	10·6	9·6	8·0	5·9	8·3	4·5	2·8	4·6	6·6	7·1
Difference	—·1	—·2	+·1	—·4	—·3	—·1	+·4	+·1	—·2	+·1	—·2	+·1

digests of pure proteids be allowed to run for four, twenty-four and forty-eight hours, respectively, care being taken to maintain exactly the same conditions of working, and to prevent evaporation of water, it will be found that whilst the hydrochloric acid and total nitrogen in the mixture have remained perfectly constant, as would be anticipated, the phenolphthalein end point has increased, the alizarin probably slightly diminished, and the drops' end point considerably diminished, indicating an extension of the range of titration from the phloroglucin drops' end point to the phenolphthalein end point, due, presumably, to the liberation of basic groups on the one hand, which are capable of affecting the drops' end point and not the phenolphthalein end point, and on the other hand of carboxylic groups capable of affecting the phenolphthalein and not

[1] See fifth annual report New York State Cancer Laboratory.

interfering with the drops. It may, however, be said that a marked variation between the phenolphthalein end point, after allowing for phosphates and the gravimetrically determined total available hydrochloric acid, is seldom to be recorded within three or four hours from the commencement of the process where normal peptic digestion is concerned.

A long series of determinations of total nitrogen and of nitrogen in the phosphotungstic filtrate in comparison with the figures obtained on volumetric titration with phloroglucinvanillin drops, alizarin and phenolphthalein has failed, as would be expected from the above, to show any close relationship. After correcting the differences between the end points of drops and alizarin, alizarin and phenolphthalein end drops and phenolphthalein, for the effect due to phosphates and other secondary causes, the widest variation is

TABLE IV.

Case.	1	2	3	4	5	6	7	8	9	10	Avg.
Alizarin to Phenolphthalein	25	19	30	26	43	31	17	31	21	35	—
Phosphates	4	2	5	4	5	4	1	5	3	5	—
Difference	21	17	25	22	38	27	16	26	18	30	24·0
Total nitrogen	113	107	131	120	228	135	80	127	104	144	128·9
Phosphotungstic filtrate	23	19	23	27	40	26	18	24	19	27	24·6

still found to obtain in the ratio of these figures to the total nitrogen and phosphotungstic nitrogen. The range from alizarin to phenolphthalein is generally from a fifth to a sixth of the total nitrogen, as is the phosphotungstic nitrogen. The range from drops to alizarin varies far more, and that of drops to phenolphthalein may be anything from a half to a tenth of the total nitrogen, but it may be said that where the digestion is advanced, the titration range is higher in proportion to the total nitrogen, and that the highest relative figures are obtained in those cases in which secondary decomposition is well marked. The results of this nature have usually been confirmed by finding discrepancies between the volumetric and gravimetric estimation of chlorides. Both these factors may be taken to indicate the probable liberation of amido and carboxylic groups having a specific effect upon the state of equilibrium of individual indicators. That the phloroglucinvanillin end point actually

represents the end point of free and totally dissociated hydrochloric acid may be proved by determining the osmotic pressure of the stomach contents in a fresh state, after neutralization to the drops' end point to the alizarin end point, and to the phenolphthalein end point. In the first period up to the drops' end point the osmotic pressure cannot be found even approximately by summing those of its constituent solutions, a simple calculation showing that free hydrochloric acid has been neutralized by soda, thus forming only two ions and a slightly dissociated molecule in the place of four. After the phloroglucinvanillin end point, the determinations of the freezing point indicate a reaction between ammonium chloride or some similar body and soda, which, as would be anticipated, fails to result in as large a diminution in the osmotic pressure as is observed in the first portion.

The observation that the phosphotungstic filtrates obtained from peptic digestion mixtures may reach very considerable proportions in spite of the absence of leucin, tyrosin and all final products of disintegration of proteids, must be attributed, in all probability, to the presence in the mixture of derivatives of these mono-amido acids possessing at least twice as large a complex. It is very probable that this particular mono-amido acid grouping, even in relatively complex molecules, may lead to a differentiation of those compounds possessing it from those possessed of di-amido acid grouping, which are precipitated by phosphotungstic acid.

The results obtained with artificial peptic digestion mixtures and normal and pathological stomach contents may be summarized as follows:

(1) In a normal peptic digestion that has only been allowed to run three or four hours after a purely proteid or an Ewald test meal (and allowing for the effect of phosphates and carbonic acid), the phenolphthalein end point gives an accurate estimate of the total available hydrochloric acid present in the stomach, either free or combined with proteids.

(2) The end point to drops of phloroglucinvanillin gives a fair estimate of the actual free hydrochloric acid.

(3) The range from phloroglucinvanillin drops to the phenolphthalein end point, after allowing for phosphates, is a function of the proteids present in the mixture and the extent of their hydrolysis or decomposition.

(4) This range increases with advancing digestion or decomposition as does the phosphotungstic nitrogen, the total nitrogen and chlorine remaining approximately constant.

VII. TITRATION OF TRYPTIC DIGESTION PRODUCTS.

A series of digestion experiments, making use of the extracts of pancreas and duodenum of human beings and animals which were carried out with a different purpose in view, were utilized to determine the effect of successive stages of pancreatic digestion on the end points of indicators. Whilst a constant quantity of sodium carbonate was present in each digest, the proportions of pancreatic extract and duodenal extract were permitted to vary within wide limits. Constant weights of egg-white and plantose, a vegetable albumen, were employed, and the period during which they were submitted to the action of digestive ferments varied from four to forty-eight hours. In order to economize space it has been found necessary to omit the tables, but it may be said that in each case, with increasing concentration or extension of the time of action, an increased quantity of nitrogenous products brought into solution was invariably accompanied by an equivalent increase in the total range of titration from phloroglucinvanillin to phenolphthalein, the influence on the period from phloroglucinvanillin to alizarin being more marked than that from alizarin to phenolphthalein. It was also observed that after a constant amount of nitrogen was obtained, owing to the proteids being entirely in solution, further digestion resulted in a still further increase in the titration range, the phenolphthalein end point requiring slightly more alkali or less acid, and the phloroglucinvanillin end point more acid than previously. After allowing for the influence exerted by carbonic acid and other known causes of interference, it may be said that in an advanced stage of digestion the range of titration is frequently almost equal to the total nitrogen; certainly in excess of one-half, indicating a more advanced stage of disintegration than was observed in peptic digestion experiments.

VIII. ON THE CONSTITUTION OF PROTEIDS.

In the course of the last twenty years an immense amount of research has been devoted to the solution of the problem of the constitution of molecules of various types of proteids and simpler

nitrogenous bodies. Kühne, Chittenden, Hofmeister, Kossel and their students, as well as numerous other investigators, have attempted to arrive at a clear understanding of the way in which the molecule is built up, breaking it down by means of various reagents until simple, readily recognized bodies were obtained; and estimating the proportions of such bodies with a view to arranging a possible molecular complex which would include them all. Fischer, on the other hand, has devoted his attention principally to the problem of synthetically producing bodies possessing the characteristics of proteids from their elements by building them up, principally through condensation of amines of the type of glycocol and its derivative glycyl-glycin, the resulting bodies possessing properties very similar to those of the natural peptones. Osborne has separated pure specimens of a large number of these nitrogenous compounds derived from the proteids, but possessed of a simpler complex, and yet far more complicated than the final products of disintegration (leucin, tyrosin, etc.), and by preparing the hydrochloric acid salts of such bodies as edestin, arrived at conclusions regarding the probable molecular weight.

Paal was the first who attempted to throw light on the nature of the proteids, albumoses and peptones by preparing the compounds which they form with bases and acids. By analyzing the preparations obtained in this way at various stages of digestion this investigator attempted to draw conclusions not only regarding the absolute size of the molecules of the various compounds isolated, but also regarding the various more or less resistant portions of the original proteid molecule subjected to hydrolysis. Paal observed that hydrolysis of a complex molecule to form two simpler molecules, indicated by the increase in osmotic pressure of the mixture, was generally associated with an equivalent increase in the ability to take up hydrochloric acid. This indicates the probable liberation of an NH_2 group in the ordinary process of hydrolysis. It appears, however, extremely probable that by means of suitable indicators it should be possible to estimate not only the total number of such NH_2 groups present in the molecule, but also to differentiate between the different types that may possibly be formed varying from those possessed of extremely basic to those possessed of almost neutral or even acid characteristics. In a recent publication dealing with the products of decomposition of certain

proteids, Osborne and Harris estimated the percentages of ammonia and so-called basic and non-basic nitrogen, the two latter being differentiated by the fact that amido bases are precipitated by means of phosphotungstic acid, whilst the amido acids are passed through into the filtrate.

In carrying out comparative series of experiments on the nutritive value of certain animal and vegetable albumens, we have frequently noted far greater variations in the alizarin end points than in those of phenolphthalein and phloroglucinvanillin on titration, and this is of especial interest taken in conjunction with Osborne's work on the fractionation of the products of decomposition of certain proteids referred to above, for it must be remembered that whilst phloroglucinvanillin is sensitive to almost all the NH_2 groups that could eventually be liberated from a union similar to that existing in glycylglycin, alizarin is only sensitive to ammonia and those amine groups which are possessed of fairly strong basic characteristics, and phenolphthalein only slightly to ammonia, as was seen in a previous section of this article.

It is highly probable that the range of the various periods between the titration points of the different indicators in the course of peptic or tryptic digestion may prove, when worked out, to afford valuable indications regarding the type of combination which each individual, freshly exposed amid group may be said to possess; whether, for example, it is associated exclusively with carbon, to which only hydrogen is attached, or to what extent it is removed from CO groups, or whether it is present in the form of an acid amid. Unfortunately time does not permit of our carrying this question further. We should merely wish to emphasize the value of volumetric methods of titration in following the progress of various digestive processes, and any reaction in which the hydrolysis of proteids or less complex nitrogenous compounds is concerned. The small amount of work already carried out in this direction makes it appear probable that such a method of procedure, when taken in conjunction with osmotic pressure and other physico-chemical determinations, may be expected to throw some light on the methods of grouping of the various atom complexes presesent in different types of proteid molecules.

From analyses carried out by Dr. Wheeler in the laboratory it appears probable that each advance in the digestive process is

accompanied by a very appreciable increase in the titration period lying between the drops and alizarin end points representing in all probability the liberation of weak basic NH_2 groups presumably on hydrolysis of a union of the type — CH_2 — NH — CO — present in glycyl-glycin and other compounds of a similar type investigated by Fischer. The action of any hydrolyzing agent would leave the group — CH_2 — NH_2 free to combine with any available acid possessed of sufficient strength until equilibrium were established. The period from alizarin to phenolphthalein which very probably represents a stronger NH_2 group, remains much more constant until an advanced degree of decomposition is reached, at which point it increases, but not in the same proportion as does the other period. Taking the total range of titration from drops to phenolphthalein, from drops to alizarin, from alizarin to phenolphthalein, total nitrogen and phosphotungstic nitrogen, it will be seen that as the disgestive process advances all other quantities increase in proportion to the nitrogen, the period from drops to alizarin more rapidly than that from alazarin to phenolphthalein.

It is interesting to note that the range from alizarin to phenolphthalein compared with nitrogen varies from 1 : 18 to as low as 1 : 3 or 4, which is in agreement with the findings of Paal. This investigator prepared compounds which were practically HCl salts of the products of proteid hydrolysis, and from his analyses it may be calculated that the acid equivalent varied in proportion to the nitrogen from 1 : 18 to 1 : 2, passing from relatively complex albumoses to the simplest obtainable peptones. This is in agreement with the findings of Latham, Lieberkühn and others, who have given the soluble albumoses a formula containing 18 atoms of nitrogen. Osborne, in determining the acid-combining equivalent of his crystalline proteid edestin, found two distinctly differing combining capacities, one which was 1 : 144 and the other 1 : 72, showing in all probability one weak and one strong basic group free to form combinations with acids.

IX. BLOOD SERUM.

A series of comparative titrations of the blood serum gives average results recorded in Table III, which are based on the effect exerted by 1 c.c. of clear, separated serum towards a variety of indicators. It will be seen that a fairly uniform result is obtained

with different varieties of serum, all of them being slightly acid to phenolphthalein, requiring from ·1 to ·2 c.c. of n/10 solution; and alkaline to alizarin, requiring from ·4 to ·6 c.c.; strongly alkaline to phloroglucinvanillin drops, the end point varying from 1·2 to 1·6. The total nitrogen of the serum appears to be about five times the total range from phenolphthalein to the drops' end point. The end point of Porrier's blue lies slightly below that of phenolphthalein, and the precipitation point of proteids appears to coincide fairly well with the end point of alizarin or to lie slightly beyond. The effect of phosphates is not large enough to account for the titration differences, giving an average of ·2 from the phenolphthalein to the alizarin end point and ·2 from the alizarin to the drops' end point. It is therefore apparent that the proteids themselves play an important role in affecting the end point of given indicators. The variations from the normal observed in human beings under pathological conditions will be dealt with in another publication.

TABLE V.

Indicator or Reagent.	Guinea Pig.	Rabbit.	Bullock.	Hog.	Antitoxic Horse Serum.
Phenolphthalein	+ ·1	+ ·1	+ ·1 to ·2	+ ·05 to ·1	+ ·1
Alizarin	— ·5	— ·6	— ·4 to ·5	— ·65	— ·7
Drops	— 1·2	— 1·45	— 1·4 to 1·5	— 1·55	— 1·6 to 1·7

The wide variation between the end points of the three indicators employed above on titrating blood serum, emphasizes the necessity of establishing certain uniform standards when determining the degree of alkalinity of blood serum in pathological cases. To avoid confusion when titrating blood serum from cases of diabetic coma or cancer cachexia, it has been customary in this laboratory to determine the end point of the indicators enumerated above, as well as that of lakmoid, which seems to have been fairly extensively employed for this purpose.

X. TITRATION OF URINE.

The discussion of this subject, so far as pathological conditions are concerned, will be reserved for another publication, but it may be remarked that under normal conditions the urine is about equally acid to phenolphthalein and alkaline to alizarin,

and it may be said that some serious disturbance in the metabolic equilibrium has taken place when urine is either acid or alkaline to both alizarin and phenolphthalein. In other words, since the passage from alizarin to phenolphthalein represents the neutralization of the second acid group of phosphoric acid, the excreta of the kidneys cannot be said to be satisfactory unless the first acid group of the phosphates is entirely neutralized by bases and the third entirely free, the end point lying somewhere between the neutralization points of the first and the second.

The presence of small quantities of amido bodies (lying between ammonia and urea in basic properties) could not produce a very appreciable effect upon indicators in comparison with the large amount of phosphoric acid present in the urine, and it is consequently not a matter of such importance to determine their influence as was the case in dealing with stomach contents, serum, etc.

In the presence of any considerable quantity of ammonia, which, in contradistinction to urea exerts a powerful effect upon alizarin and phenolphthalein, the urine would be less acid, or even alkaline to phenolphthalein and more strongly alkaline to alizarin than is normally the case.

In conclusion the writer wishes to express his indebtedness to Dr. David E. Wheeler, by whom a considerable number of the analyses referred to in this paper were carried out.

XI. SUMMARY.

In this paper the physico-chemical theory of indicators has been discussed in so far as its principles are found to be applicable to the solution of problems involved in the volumetric analysis of physiological solutions.

Practically all indicators are sensitive to strong acids and strong bases. They may, however, be divided into three distinct classes when tested with a series of weak acids and weak bases of the type present in physiological solutions. At one end of the scale are those which in virtue of an extremely weak acid affinity are particularly affected by weak acids and are, comparatively speaking, indifferent to weak bases; whilst at the other end of the scale are to be found those which are possessed of strong acid or weak basic combining groups which render them very susceptible to the influence of weak bases but more or less indifferent to that of weak acids.

It is further possible to differentiate between a series of two or more acids or bases present in the same solution provided one can find indicators, the combining affinity of which to form neutral salts lies intermediate between those of the bodies to be titrated. A good illustration of this mode of differentiation is the recognition of the three acid groups of phosphoric acid, the first one of which coincides with the first alizarin end point, the second with the second alizarin end point, or with the phenolphthalein end point, and the third with the phenolphthalein end point in the presence of barium chloride; or aspartic acid, for example, the first acid affinity of which is neutralized at the alizarin or phenolphthalein end point, the second only at the end point of Porrier's blue. Carbonic acid affords an interesting contrast to aspartic acid, neither of its acid groups being strong enough to affect alizarin, one only giving an indication with phenolphthalein and both with Porrier's blue. It will thus be seen that in their behavior towards phenolphthalein and alizarin we have a sharp differentiation between the strongest acid affinities of aspartic and carbonic acid respectively.

At the other end of the scale phloroglucinvanillin is sensitive to the amido group present in aspartic acid, and entirely indifferent to the acid groups referred to above. Whilst Porrier's blue is absolutely indifferent to ammonia and all weak basic groups, alizarin is sensitive to ammonia, but not to amido groups of the type present in glycocol, leucin and tyrosin. Phloroglucinvanillin as an indicator gives a sharp titration of NH_2 groups of this class, and one of the NH_2 groups in asparagin. It is unaffected by the second or amido group of asparagin, and those of the same type present in acetamid, formamid, urea, etc.

In discussing the effect of albumoses, peptones, etc., on indicators, it was shown that perfectly pure preparations of these substances show a wide range of variation in titration end points, attributable presumably to the influence of weak basic groups present in the molecule; further, that in advancing hydrolysis the range from the lowest to the highest end points was increased, and that this effect cannot be attributable to the influence of phosphates, organic acids and chlorides to the same extent as has been generally supposed.

The comparison of volumetric with gravimetric analyses of normal and pathological stomach contents showed that provided a plain Ewald, or, by preference, a purely proteid test meal were employed,

and the materials examined in the space of three hours, with very few exceptions the phenolphthalein end point gives a fairly accurate estimate of the total available hydrochloric acid present in the stomach, either in a free state or combined more or less feebly with proteids. The influence exerted by phosphates is usually small, and may be allowed for by making a separate estimation of the quantity present according to a method suggested by the writer in a previous paper. The end point of phloroglucinvanillin drops used on a warm plate gives a fairly accurate estimate of the actual free hydrochloric acid. The range of titration from the phloroglucinvanillin end point to that of phenolphthalein, after allowing for the influence of phosphates and traces of organic acid may be said to be a function of the basic affinities of proteids and their decomposition products present in the solution. The total range and the end points of intermediate indicators are dependent upon the total quantity of such bodies present in the solution and the extent of their hydrolysis or decomposition, and provided comparable conditions of experiment are employed this range may be said to be fairly proportionate to the peptic activity of the mixture.

Under pathological conditions, where hydrochloric acid is absent or diminished in quantity, and peptic digestion fails to take its normal course, especially where organic acids have been produced under the influence of bacteria, the above rules are no longer applicable. The total range no longer bears the slightest relationship to the titration results; chlorides determined gravimetrically are found to be far below the phenolphthalein end point; the nitrogen present in so-called phosphotungstic filtrate rises above the normal, which is from 20 to 25 per cent. of the total nitrogen in a well-digested mixture. All these factors point to the abnormal breaking down of proteids beyond the point normally reached in peptic digestion in the stomach, presumably under the influence of bacterial enzymes functioning in a neutral solution with the liberation of additional weak basic and acid groups, as the result of the abnormal hydrolysis.

In tryptic digestion due allowance must be made for the influence of a known quantity of sodium carbonate, which may be estimated independently. Both the acid groups of this body are capable of exerting an influence upon Porrier's blue, whilst only one affects phenolphthalein, and other indicators, such as alizarin or phloro-

glucinvanillin, are entirely unaffected. After allowing for the influence due to carbonic acid, it is found that the range of titration increases with increasing digestion, being at the early stages more or less proportionate to the amount of proteid brought into solution as estimated by the total nitrogen, but subsequently increasing in undue proportion to the total nitrogen as digestion proceeds, with the formation of simpler nitrogenous products.

The bearing which work of this nature may have on the solution of certain problems connected with the constitution of proteids and their decomposition products was also discussed. Titrations of normal blood serum showing a wide variation with different indicators which could not possibly be attributed to the inorganic constituents of the serum were tabulated and the necessity of an agreement upon certain specific indicator end points for serum titration emphasized.

The titration results on urine were shown to be fairly dependent on the amount of phosphates present, the small proportion of amido bases and weak acids present exerting a relatively small effect in normal cases. A normal urine should be acid to phenolphthalein and alkaline to alizarin, the end point lying somewhere between the neutralization points of these indicators. In other words, whilst the first acid group of the phosphates should be neutralized, the third acid group should remain free, varying proportions of the second group being neutralized or not, according to the state of equilibrium of the system. Naturally, in the presence of any considerable quantity of ammonia which in contradistinction to urea exerts a powerful effect upon alizarin and phenolphthalein, the urine would be less acid, or even alkaline to phenolphthalein and more strongly alkaline to alizarin than is normally the case.

In conclusion, a plea must be raised for the establishment of a more accurate standard of titration of various types of physiological solutions, definite indicators with definite end points being employed, so that the work of various investigators may be in some sense comparable, in order that the results of volumetric analyses may have their scientific value when used in conjunction with the more exact gravimetric and physico-chemical methods, which can scarcely be said to possess as wide an application.

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PHARMACY AND CHEMISTRY AT THE WORLD'S FAIR.

By Carl G. Hinrichs, Ph.C.,
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(*Continued from p. 474.*)

V. THE PHILIPPINES: A LAND OF PROFESSIONAL PHARMACISTS.

When old Tom Benton, of Missouri, said, "There to the west, there lies India," he little thought that when a half century had scarcely rolled away, the great railroad he then opened for the benevolent assimilation of the commerce of India would be carrying American soldiers on conquest bent to the bloody swamps of glory, malaria and mosquitoes of the Philippines—a country whose men, customs, climate and products are as mysterious and wonderful as the most impossible tales from India's jungles; a land whose people are small of stature and intelligent, but with as much of the old Adam to the running foot as any people on the face of the globe; islands where the gentle zephyrs of the typhoon waft the deep and continued rumblings of the quaking earth far out to sea. Fortunately there was enough left after all the natural and unnatural acts of nature and man during the past ten years to bring to St. Louis one of the grandest displays of the Fair, a collective exhibit worthy of an empire.

The Philippine Commission, in addition to showing the many naked and half-naked tribes of the islands in separate villages, have large separate buildings, namely: *Agriculture*, implements and

products. *Forestry*, woods, resins, roots and barks. *Education*, university, college and primary-school work. *Art*, wonderful paintings and drawings by native artists. *Household Arts*, knitting, etc. *Commerce*, sugar, leather, alcohol, wines and cigars. There are features in the general exhibit that may interest the individual visitor, such as the war exhibits and the like.

What will especially interest Americans is the Philippine way of doing things. In front of the large Agriculture Building are the many crude wooden plows, harrows, rollers carrying wooden spikes, sugar presses, hemp and rope-making appliances, all typical of the old agricultural methods of the Gauls and Romans. The spirit that pervades the farmers is that some day we will use American plows, but these are good enough for us. Especially interesting is the oil press exhibited. Imagine a square frame of heavy timbers, the upper having a central and longer opening than the lower cross piece; into these openings wooden timbers slip, leaving little play in the lower opening. The thus formed open jaws are tightly forced together by two wedges driven into the upper opening behind the jaws. Cocoanut, sesamé oil and the like are made by the natives with such presses; the press cakes are used as stock feed.

The juice of the cane is expressed by vertical rollers; one roller being connected with the motive power, the carabao, by a long timber swinging about the focus in a large circle. The other rollers are connected by teeth arrangements working in corresponding openings in the motive roller. The three-roll presses, made of stone and hard wood, move thus in unison. The tall two-roll presses have spiral-thread arrangements carved in the wood for some two feet at the top, thus insuring the necessary motion of both rolls. As the presented cane stalk would slip up and down the roll when presented by the indolent workman, a wooden timber having more or less of a rounded wedge-shape with a tunnel through the center, takes the presented stalk. The juice running down the rollers is collected in pans or tubs. This is then carried to the evaporating pans; the one shown is of iron, 1 meter across and 1/3 meter in depth. When the farmer finds the syrup becoming of such consistency that it becomes solid on cooling, he pours it into earthenware pots holding probably 10 gallons. These pots look like buckets; the walls are about 1/3 inch in thickness. In this form, pilones, the husbandman sends his crude sugar of deep-brown color to the refiners in Manila

and the villages in the interior. All qualities of sugar, for the most part of brownish tint, are shown in this Agriculture Building.

Indigo receives attention in the islands; while the plant grows in temperate regions, here it yields three crops a year against one crop in the more northern lands. The leaves and stalks are gathered before the fruit appears and expressed. The yellowish juice passes through greenish and blue shades, when the indigo separates out an insoluble powder. Thirty hours usually suffices for this change. The samples of indigo shown are of very fine appearance, made into the usual cylindrical forms.

There are a number of flour-bearing plants in the islands. Harina de maiz is our familiar corn meal. The yucca and many palms yield flours, though rice forms the great staple. The mortars in which rice is beaten into powder are varied. The idea underlying many of the wooden mortars is to imitate a boat. In the center a round hole is gouged out. In this wooden mortar the rice is placed and contused with wooden mallets or wooden pestles. Many very formidable mortars are shown, also small hand affairs holding little more than a thimbleful. Some wooden mortars of larger size are hollowed out of the upright trunk. Burrstone mills are also made by the natives, the rice being fed through the top stone, which has a small hole leading to the grinding surfaces.

The most noted starchy food next to rice is the pith of the *buri* palm. This grows on all the islands, is graceful; its fruit is not edible. Cutting down the tree the pith is removed; placed in tanks, the acrid bitter juice drains off; it is then dried and pounded in mortars, the starch now separates as a fine flour. This preliminary draining off of acrid juice is necessary in very many other instances, *e. g.*, making cassava.

The Commerce Building should not be overlooked. It houses the tobacco, fermenting, fiber, distilling, leather and paint industries. The case of Ilang Ilang oil will be the most attractive, though small, for it furnishes the perfumer with the Eastern attar of rose. This oil is obtained from the yellow flowers of Ilang Ilang tree; the blossoms are exceedingly fragrant, some 3 inches long. A tree will often yield 800 pounds of blossom during the year, 75 pounds yielding a pound of the oil, costing in the market some $50, so we see the distilling of this oil is not unprofitable when you consider the tree thrives wild and also is readily planted and cultivated. The

flowers are distilled with water from a common still. The distillate of oil and water separates into two layers, the lower being the oil. This is tapped off, filtered through talcum and furnishes a water-white first quality oil. The last runnings are more yellowish in tint and have a slight smoky odor. B. Largado, of Manila, shows some 10 pounds of the various grades.

The Spanish naturally never forget tobacco. Here are all qualities of leaf and cigars, cigarettes and the like. The most striking is the manner in which the finest quality are sent into the trade. Each box looks like a chemical laboratory; it is filled with test tubes tightly corked, each test tube containing a single cigar.

The firm of Ynchausti & Ca., Tanduay, Manila, are extensive makers of alcohol, spirits, liqueurs, rhum, etc. The alcohol shown is water-white, of first and second quality. Caña is the name of alcohol made from sugar cane. Ron is rhum. The exhibit is very elegantly gotten up.

We have read of the deadly crazing "vino" that many of our troops attacked with gusto and were sent home in a pitiful condition. Palms are many in the islands; sweet juices may be extracted from the flowers. Fermenting, distilling and the like, a powerful intoxicant results. Many wines of this kind, gins, true wines, moscatels and beers make up a large portion of this exhibit.

The Forestry Building boasts many beautiful slabs of timber. Slabs from a single tree 10 feet across and many feet long are common. Of exquisite color, weight and hardness, these trees furnish the best of wood for the carpenter.

The collection of barks, roots and resins used medicinally number into the thousands. We may say that there are, if anything, too many. It is simply bewildering to see the wealth of drugs furnished by the Philippine forests.

Of resins there are several hundred; also, in many cases, the latex is shown. Probably a ton of one single resin, that known as *alamaciga*, obtained from *Agathis canarium*, testifies to the importance of this branch of forestry. This resin is in enormous lumps, many being over 6 inches through. The resin is hard, of pale yellow to brown tints, and quite translucent. It is still in the original Philippine package, long knitted bags of thin willow or other wood thongs; the mesh averages 2 inches. This resin comes in the class of dammar, kauri and other hard resins. It makes good varnish.

A mound some 10 x 10 feet at the base makes a very effective display of gutta-percha balls. These balls average 4 inches in diameter, the size of a cocoanut. This is a very common product of Mindanao. Some large cylinders of gutta that had been worked before the fire form layers about a thin stick, the whole being over a foot in diameter.

Brea gum is also shown in quantity. This gum is wrapped in the leaves of the nipa palm; it is a soft, glutinous variety of gum, of dark, almost black, tints. In a small jar is also shown a white resin that was obtained from brea by solution in alcohol.

The resin *nato* or *colobob* is brought into the trade in small dark cylinders, and looks for all the world like crude chocolate.

Resin of the aromatic myrrh tree is also glutinous; it reminds one of cherry-tree gum in appearance.

Macabuhay is the Tagalog for *Tinospora crispa*. This plant furnishes stems, the heart wood of which is yellow, the bark of a light brown. A decoction of the stems is brewed by the natives and used as a febrifuge, tonic emmenagogue, and antiherpatic. They also cook the bark in oil; this furnishes them an anti-rheumatic.

Agiya-ng-yiang is Visayan for jequirty or *Abrus precatorius*. The familiar little reddish seeds with a black spot on one end are used as a poison, in decoction likewise as a collyrium. The roots and branches are the Eastern substitute for licorice; in decoction these are pectoral.

Andropogon muricatus is known as *amoras* in Ilocan. The dried roots are shown in quantity; they are fragrant, and are used as moth balls, preserving cloth from the attacks of moths. In decoction it is used in tonic baths. Our familiar oil of vetiver is distilled from the aromatic roots of this plant.

One of the finest and largest loments ever seen by the writer is the *Bayuga fruta* or *Balogo* in Visayan. The individual seeds alone are over 2 inches across, flattened and quite round. Some eight such seeds make up the pod; the contraction between each seed seems to almost separate this pod.

One of the beauties of the forest is the *arbol de fuego*, or tree of fire. In the rainy season, May and June, this tree bears no leaves, but is aflame with large blossoms of red color. These flowers are a half foot across.

Philippine pharmacy is professional. In spite of all the bad that has been written concerning the Spanish conquerors, the professions

of medicine, pharmacy and law were and remained true professions in the strictest sense of the word. No prospective pharmacy student could enter any of the three schools of pharmacy in the Philippines if he had not passed through a high school. Then follows four years' active application to the fundamental studies of chemistry, inorganic, organic and analysis; pharmacy; theory and practice, botany, physics, materia medica. During the four years' course he also practices two years in the store before he may appear before the board of examiners. In the main center of education, Manila, two schools are found, the most important being the department of the University of San Tomas, having a faculty of eight professors and 150 students.

Drug stores are not found on every corner in Manila; in fact, fifty stores supply the 450,000 people of the metropolis and suburbs with their drugs. It must be remembered, however, that many are the natives that gather their home remedies in the jungle, and that one store to every 9,000 people is not excessive. Still druggists are prosperous; they are very important men of the community, being professional men.

What do you think of the old proposition that a druggist cannot prescribe a remedy; that a doctor may not fill a prescription? This wise rule is strictly enforced in the islands; at least, it was under Spanish rule. So far was it carried that a doctor could not even be an owner or part owner of a pharmacy, while a druggist, becoming a doctor, had to dispose of his store before he would be granted the right to practice medicine. This may look absurd; but how many are the doctors that send their patients to a store in this country where a doctor stands behind the counter, or even owns the store? They do not send them there if they can help it. This division undoubtedly adds to the friendly feeling that should exist between the prescriber and the compounder, and adds greatly to the security of the patient.

The drug-store is called a botica or Farmacia. They are usually spacious stores on the European plan. Cases are displayed about the walls; the laboratory is in the rear, separated from the store proper by a railing. Everything looks solid; the floors are of marble, and everything is kept scrupulously clean. At present Manila boasts of an American drug-store; likewise the great English firm of A. S. Watson & Co. have a branch here as well as in other Eastern centers, such as Hong Kong.

The Spanish Pharmacopœia is the standard formulary; then comes the Codex, the German Pharmacopœia, the British and, last, the U.S.P. As the physician would never think of prescribing the patent medicine of Mr. So and So, the druggist is still a druggist in the Philippines. Patent medicines are sold to a slight extent by druggists: Bromo-Seltzer goes lively nowadays; Dr. Jayne's Pectoral, Hood's Sarsaparilla, Antikamnia and the like are called for by Americans. The low-grade Filipino usually buys external remedies, such as oils, plasters, etc. He does not trust the internal remedies to any great extent; still this is also noted in the Mexican, who prefers his aceite every time. The smallest sale is always five cents. Other goods rapidly increase to fancy figures.

Co-operation of druggists is represented in the Union Farmáceutica Filipina. This company has ample capital, and makes galenical remedies for a large number of druggists.

Under the Spanish law the patent-medicine men had to deposit their formula with the proper medical board. Analysis then made had to tally with the stated composition. This naturally kept down the low practice noted in many cases among patent-medicine people. It safeguarded the physician, druggist, and also the people. It seems to us, however, that while a partial application of these rules might be well, still a man is entitled to the fruits of his brain-work. We all know that even State officials, who are sworn to secrecy, often are quite loquacious if approached in the proper manner. This rule has been dropped by the American conquerors.

In closing, it may be well to add that the Igorrotes were not allowed to bum around Manila in their breech-cloth attire, that appeals so strongly to the visitors at the Fair; that while there are dog-eaters, tree-dwellers, head-hunters, etc., in the Philippines, those natives in the coast regions are more or less civilized, especially in Luzon. When you gaze on their art works, their dwelling-houses and manufactures at the Fair, you cannot help thinking that a goodly portion of the people are as civilized as need be, for the tropics, at least.

With the full-blooded Filipino, Prof. Leon M. Guerrero, I conversed in Spanish, aided by his secretary, Mr. Enrique Lopez, a Castillian from the Islands. Professor Guerrero was president of the Pharmacy Examiners, is a noted botanist, and founded the *Liceo de Manila* in 1900.

CLEMENS ALEXANDER WINKLER.

BY CARL G. HINRICHS, PH.C.

On the 8th of October, in Dresden, the most distinguished inorganic chemist of Germany passed away. Born in Freiberg, the celebrated mining district of Saxony, December 26, 1838, son of the well-known chemist and member of the superior mining council of Freiberg, Kurt Alexander Winkler, it is not surprising that he took up the study of chemistry. He studied in the Bergakademie of his native town, and graduated as Doctor of Engineering in 1861. He then accepted the position of director of the Pfannenstiel Prussian Blue Works. In 1864 the degree of Doctor of Philosophy was conferred upon him.

During the 60's many practical papers came from his pen. He studied the difficult separation of nickel from cobalt, separation of lanthanium from didymium, an exhaustive study of the then newly-discovered element indium, and many other papers appeared in the *Journal für Praktische Chemie.*

In 1873 he was called to the chair of chemistry in his alma mater, which for thirty years he filled, adding lustre to this well-known school. In 1903 he retired from active work as a teacher. This position enabled him to thoroughly study the many chemical phases of the chemical and metallurgical industries. We find him again taking up his earlier studies on the Gay Lussac tower, used in the manufacture of sulphuric acid, and find him elaborate the first technical preparation of sulphuric anhydride by the contact process, doing away with the costly lead chambers.

The preparation of large slabs of ductile nickel and cobalt was first solved by him in the early 70's. His untiring examinations of many alloys, new minerals and the like, found its reward in the discovery of a new element. Swelling with pride that he had duplicated the achievement of the French savant Boisbadron of 1876, when he discovered gallium, he patriotically named his new element after the Fatherland—germanium. When we recollect that this germanium is found only as a rare complex sulphide mineral, in minute quantities as an incrustation on rich and rare silver ores of the Himmelsfuerst mines near Freiberg, the almost microscopic examinations made by this chemist of Saxon minerals become patent to all.

The careful studies on fire-damp and the many experiments with sulphurous acid gas naturally demanded of him a thorough examination into the modes of estimation of these bodies. As a result we to-day possess his authoritative work, "Lehrbuch der Technischen Gasanalyse," now in its third edition. As modern manufacturing processes demand quick and accurate methods of estimating the purity of products during the process of manufacture, he thoroughly studied volumetric processes. His "Uebungen in der Maasanalyse" contains all that is reliable on volumetric analysis. There are many earlier works on kindred subjects, but the last two books are among the most widely known.

In latter years he has appeared as critic, he has pointed out many of the erratic and dangerous philosophic notions of the modern chemists, and called for indisputable facts on radium and determination of atomic weights.

THE ANATOMY OF EDIBLE BERRIES.[1]

By A. L. Winton.

THE RED RASPBERRY.

(*Continued from p. 441.*)

Testa (*Fig. 9*, S).—The seed coats of the bramble fruits resemble closely those of the stone fruits, the chief difference being that the epidermal stone cells are wanting.

(1) Epidermis (*Fig. 9*, ep).—The cells are polygonal in surface view, the average diameter being 0·035 millimeter and the maximum 0·070 millimeter. In transverse sections they are cushion-shaped, with a cuticularized outer wall.

(2) Nutritive Layer (*Fig. 9*, p).—The cells in this layer, having fulfilled their mission, are empty and are often more or less collapsed.

(3) Brown Layer (*Fig. 9*, iep).—The inner layer of the testa consists of cells of the same kind as in the outer epidermis, but only about half as large, the maximum diameter in surface view being 0·030 millimeter and the average 0·020 millimeter. These cells are readily distinguished from those of the neighboring layer by their thicker walls and yellow-brown color.

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[1] This paper was printed in *Ztschr. f. Unters. d. Nahr. u. Genussm.*, 1902, 5, 785–814, and is reprinted from Connecticut Expt. Sta. Report, 1902, p. 288.

Nucellar Layer (*Fig. 9*, N).—As in the strawberry, all that remains of the nucellar tissue is the layer of obliterated cells, which in section appears as the thickened outer wall of the endosperm.

FIG. 10.—Raspberry style and stigma. × 32.

Endosperm (*Fig. 9*, E).—A transverse section shows that the endosperm is made up of aleurone-cells with remnants of other cells adjoining the embryo. On the two broader sides of the elliptical section there are five or six cell layers, but the number diminishes toward both the ventral and dorsal sides, where there are only two or three.

The cells are polygonal in surface view, but in section are for the most part quadrilateral, arranged in radial rows. The aleurone grains are the same as in the strawberry.

Embryo (*Fig. 7*, Em).—The structure of the embryo is practically the same as in the strawberry.

Style (*Figs. 10* and *11*).—(1) The Epidermal Cells (*Fig. 11*, ep) are much smaller than in the strawberry, and owing to numerous wrinkles on the surfaces are not so transparent. These wrinkles may be brought out clearly either by treating specimens with iodine as recommended by Tschierske, or better, in the writer's experience, by bleaching with sodium hypochlorite and staining with safranin. On the broadened basal portion of the style are scattering hairs like those of the epicarp.

(2) Bundles.—After heating the style with dilute potash solution, the vessels (sp) and accompanying isodiametric crystal cells (k) are clearly evident.

Examination of Raspberry Preserves.—Styles and stones (seeds with enclosing endocarp) are evident to the naked eye. The former may be examined directly under the microscope as in the case of the strawberry, and are identified by their length (4 millimeters), broadened base with hairs and small wrinkled epidermal cells. Vessels and crystal cells are also striking elements.

The stones are distinguished from seeds of other genera by their characteristic wrinkled surface and

from blackberry stones by their smaller size. Cross sections show the two layers of endocarp, the testa with cells of the outer epidermis twice the diameter of those of the inner epidermis and with a middle parenchymatous layer, the endosperm of several cell layers and the embryo.

The epidermis with hairs for the most part blunt, thin-walled and sinuous, and the crystal cells of the underlying mesocarp may be readily found in mounts prepared from the gelatinous portion of the product. Vascular elements are almost entirely wanting, as the receptacle is not picked with the fruit.

THE BLACK RASPBERRY (*Rubus occidentalis* L.).

This species, a native of the Northern United States, is the parent of the black varieties. It differs from the red raspberry chiefly in smaller size of the drupelet and their deep purple-black color, due

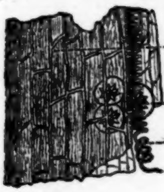

FIG. II.—Raspberry style in surface view. ep, epidermis; sp, spiral vessels; k, crystal cells. × 300.

to the dark claret-red cell juice. The pits of both are about the same size and shape. The black raspberry has practically the same microscopic structure as the red species.

Black raspberry jam or preserve is of a deep claret-red color and the seeds are stained the same color.

THE BLACKBERRY.

Most of the works on systematic botany describe the dewberry, or running blackberry, as *Rubus Canadensis* L., the tall American blackberry as *Rubus villosus* Aiton; but Bailey,[1] who has examined the original specimens in European herbaria, has found that Linnæus' species is the thornless blackberry (*R. Millspaughii* Britton) and Aiton's species is the dewberry. These names have been restored by Bailey to the plants to which they were originally

[1] *Loc. cit.*, pp. 366–379.

assigned, and the tall blackberry, which would otherwise be without a name, has been called by him *R. nigrobaccus.* The type of this latter species is the common native bush blackberry, with long fruits, and is the parent of the long cluster cultivated varieties, such as the Taylor and the Ancient Briton.

R. nigrobaccus var. *sativus* Bailey, the short cluster blackberry, is a less common native berry, but is the parent of the larger part of the garden varieties, the fruit of one of which, the Snyder, was studied by the writer. *R. fruticosus,* the European wild blackberry, does not occur either wild or cultivated in America.

The dewberry or running blackberry (*Rubus villosus* Aiton) grows wild in all parts of the United States except the extreme West, and has given rise to a number of garden varieties. The berry is hardly distinguishable in microscopic structure from the short cluster blackberry. In macroscopic structure the two are also practically the same, the only difference which the writer has detected being that the epicarp of the dewberry sometimes bears a few hairs.

Macroscopic Structure.—The blackberry agrees with the raspberry in general structure, but differs in the following details: (1) Both the drupelets and the receptacle are glabrous throughout. (2) The drupelets are firmly attached to the receptacle by broad bases, and do not separate from the latter on picking the fruit. There is really no epidermis of the receptacle, as the surface is almost completely covered by the bases of the drupelets, the epicarp of one being continuous with that of the adjoining drupelet. (3) As may be seen from *Fig. 13,* the pits resemble those of the raspberry in shape and markings, but are much larger. (4) The styles (*Fig. 14*) are but 2 millimeters long and commonly arise from a marked depression in the drupelet. They are free from hairs, and do not broaden at the base.

Histology.—Godfrin[1] notes the structure of the testa of *R. fruticosus* L., a European species, and gives a figure of a transverse section. Further than this the writer has found no literature on the histology of the blackberry.

Receptacle.—The structure of the receptacle differs in no essential detail from that of the raspberry.

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[1] Étude histologique sur les Téguments Séminaux des Angiospermes. Soc. des Sciences de Nancy, 1880, p. 153.

Pericarp.—(1) Epicarp (*Fig. 12*, epi).—The cells are for the most part elongated, the longer diameters extending in latitudinal directions on the sides of the drupelets, and in concentric circles about the styles. Stomata are always present, hairs never in *R. nigrobaccus*, seldom in *R. villosus*.

(2) Hypoderm (*Fig. 12*, hy).—As in the epicarp, the cells are commonly elongated, but are much larger, and extend in longitudinal directions.

(3) Mesocarp.—This layer is much the same as in the raspberry. Crystal clusters (k) are numerous, especially near the surface.

(4) Endocarp.—As in the raspberry, the sclerenchymatized fibers of the endocarp have secondary and tertiary membranes, and run longitudinally in the outer and latitudinally in the inner layer.

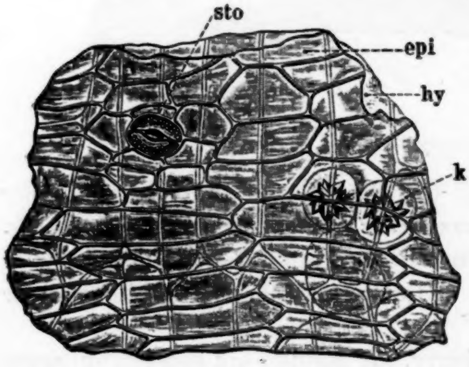

FIG. 12.—Blackberry. Outer layers of pericarp in surface view. epi, epicarp with sto, stoma; hy, hypoderm; k, crystal cells. × 160.

FIG. 13.—Blackberry stone. × 1 and × 32.

Both coats, however, are thicker than in the raspberry, the inner consisting of six to ten cell layers.

Testa.—It has been noted that the outer epidermis of the raspberry testa is made up of polygonal cells with about twice the diameter of those in the inner epidermis. The reverse is true in the case of the blackberry, the testa being much the same as a raspberry testa turned inside out. The average diameter of the outer epidermal cells is about 0·025 millimeter, the maximum 0·040 millimeter; whereas the average diameter of the inner epidermal cells is 0·040 millimeter and the maximum 0·060 millimeter.

Style (*Fig. 14*).—The epidermal cells are about the same size as

in the raspberry, but are not wrinkled to any appreciable extent. Hairs are entirely wanting. Crystals and vessels are conspicuous in potash preparations.

Examination of Blackberry Preserves.—Examination of blackberry preserves is made as described under raspberry. Styles are less numerous than in the latter, and are distinguished by their shorter length, absence of hairs and the smoothness of the epidermal cells. In cooked products it is not usually evident that the styles arise from a depression in the drupelet. The seeds are larger than in the raspberries, but in histological structure are very similar. They are, however, distinguished from the latter by the thicker inner endocarp and by the fact that the cells of the outer epidermis of the

FIG. 14.—Blackberry style and stigma. × 32.

spermoderm are about half the diameter of those of the inner epidermis; whereas, in the raspberry the reverse is true. In blackberry preserves, unlike that made from raspberries, hairs are few or entirely absent; but tissues of the receptacle, notably the vascular elements, are present.

Compared with the strawberry, the bundles are shorter, but more strongly developed, with larger and more numerous vessels. Elongated epidermal cells and crystal clusters are also distinguishable.

THE RED CURRANT (*Ribes rubrum* L.).

Both the red and white garden varieties of currant are derived from the European species, *R. rubrum.* Three varieties, grown in the Experiment Station garden, have been examined by the writer; Fay's Prolific, a red variety with berries often 1·25 centimeters in diameter, Versaillaise, a smaller berried red variety, and the white grape. All of these have the same microscopic structure.

Macroscopic Structure.—The calyx tube of the currant is united with the ovary, and the fruit (a true berry) bears on the summit the shriveled remains of the floral parts (*Fig. 15*, I). The deeply five-cleft bell-shaped calyx tube bears in its throat five petals much

smaller than the calyx lobes, and alternating with them, and five stamens opposite the lobes. The short style, about half the length of the calyx, is deeply two-cleft. The midribs of each of the floral envelopes, ten in number, are continued in the fruit in the form of longitudinal veins and are clearly seen through the transparent epicarp. The anatropous seeds, one to eight in number, are borne on two parietal placentæ (*Fig. 15*, II). As a result of the crowded arrangement they are usually flattened on one or more sides. The outer testa (*Fig. 15*, III S) is gelatinous and transparent and through it may be seen the delicate thread-like raphe and the brown hard

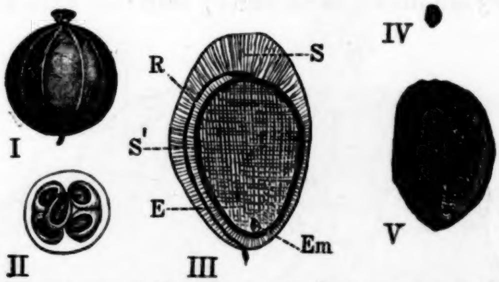

FIG. 15.—Red currant. I Fruit × 1. II Transverse section of fruit with seeds, × 1. III Longitudinal section of seed, × 8. S, gelatinous epidermis of testa; S', inner testa; R, raphe; E, endosperm; Em, Embryo. IV Seed deprived of gelatinous coat, × 1. V Same as IV, × 8.

inner testa. The minute embryo (*Fig. 15*, III Em) is imbedded in the base of the endosperm.

Divested of the gelatinous coat the seeds are from 4 to 5 millimeters long and from 3 to 4 millimeters broad (*Fig. 15*, IV and V).

Histology.—Lampe[1] has studied the development of the pericarp of *R. setosum* L. and Blyth,[2] and Villiers and Collin,[3] describe briefly some of the pericarp tissues of the red currant. The writer has studied the pericarp, seed and floral parts of the latter species.

Pericarp.—(1) Epicarp (*Fig. 16*, epi). As may be seen in surface view, the walls of the epicarp are irregularly beaded. In parts the walls are almost entirely thickened, with narrow pores; in other parts the walls are not thickened at all or only here and there.

[1] Ztschr. für Naturwissenschaft, **69**, 295.

[2] Foods: Their Composition and Analysis. London, 1896, p. 162.

[3] Traité des Altérations et Falsifications des Substances Alimentaires. Paris, 1900, p. 828.

Frequently strongly beaded cells are divided by thin partitions into two daughter cells. Stomata are numerous. Cross sections show that the cells are considerably broader than thick.

(2) Hypoderm (*Fig. 16*, hy).—Two or three cell layers of collenchymatous cells underlie the epidermis. In surface view they are polygonal with diameters twice or more those of the epidermal cells. Their collenchymatous character is seen in a cross section.

(3) Mesocarp.—Lampe found that this tissue results from the growth of cells formed during the early stages of development and not by cell division. In cross section the cells are isodiametric (from 0·1 to 0·3 millimeter in diameter), with thin walls and numerous

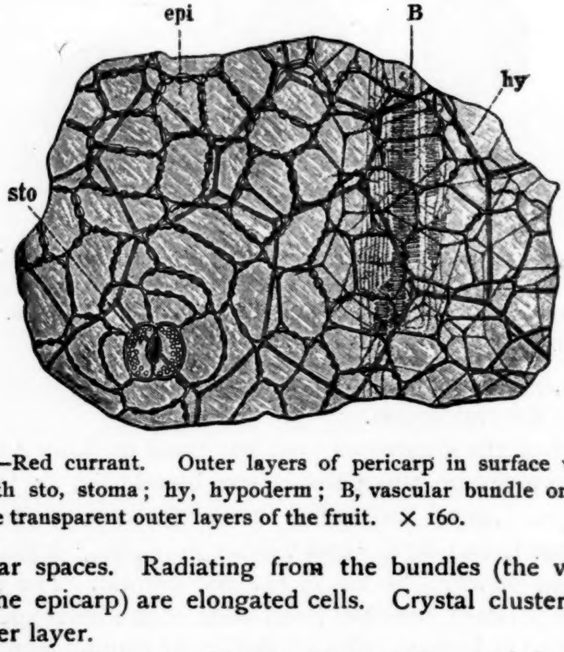

FIG. 16.—Red currant. Outer layers of pericarp in surface view. epi, epicarp with sto, stoma; hy, hypoderm; B, vascular bundle or vein seen through the transparent outer layers of the fruit. × 160.

intercellular spaces. Radiating from the bundles (the veins seen through the epicarp) are elongated cells. Crystal clusters abound in the inner layer.

(4) Endocarp (*Fig. 17*).—Unlike the gooseberry, the currant has a sclerenchymatous endocarp. This remarkable tissue, best studied in surface preparations, is exceedingly characteristic. The long cells are arranged in groups, each group consisting of five to fifteen cells side by side. The cells of adjoining groups may extend either in the same or different directions. Often the end walls of one group adjoin the side wall of the outer cell of another group. Curious crinoid like forms result from the junction of several groups. As a

rule the lumen is much narrower than the walls and oftentimes is reduced to a mere line. Numerous pores connect adjoining cells and some pierce the walls separating these cells from the mesocarp. The cells range in length up to 0·5 millimeter; the thickness of the double walls is from 0·005 to 0·02 millimeter.

Testa (*Fig. 18*, S).—(1) Mucilage Cells (*Fig. 18*, aep).—The outer layer of the testa consists of large but thin-walled cells filled with gelatinous matter. These cells are about 0·09 millimeter in tangential diameter, but often have a radial diameter of over 0·5 millimeter.

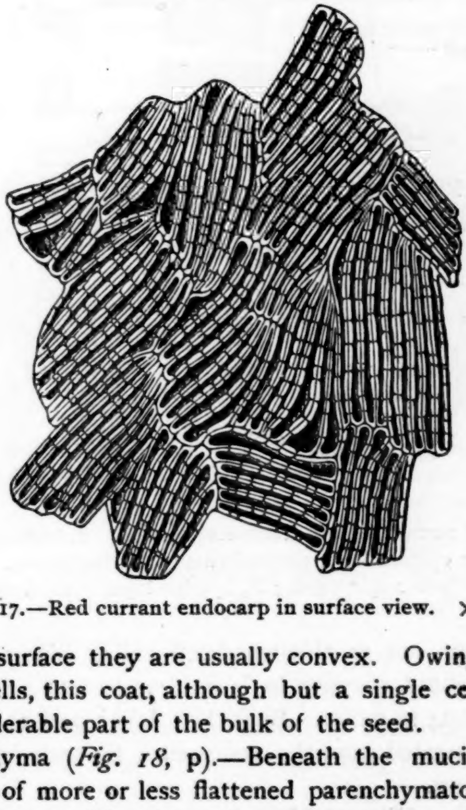

FIG. 17.—Red currant endocarp in surface view. × 160.

On the outer surface they are usually convex. Owing to the great size of the cells, this coat, although but a single cell-layer thick, forms a considerable part of the bulk of the seed.

(2) Parenchyma (*Fig. 18*, p).—Beneath the mucilage cells are several layers of more or less flattened parenchymatous cells with intercellular spaces. The inner layers are smaller than the outer and more strongly flattened.

(3) Crystal Layer (*Figs. 18* and *20* k).—In surface view the deep brown thick-walled cells of this layer are sharply polygonal with diameters from 0·008 to 0·020 millimeter. The middle lamella is

colorless, the thick membrane, brown. Each cell contains a single monoclinic crystal, which nearly or completely fills the cell cavity.

With crossed Nicol prisms these crystals appear as luminous spots in the black background, disappearing on addition of a drop of hydrochloric acid. In section it may be seen that only the radial and inner walls are thickened and that as a consequence each crystal lies close to the thin outer wall.

(4) Inner Epidermis (*Figs. 18* and *20*, iep).—Like the crystal layer, the inner epidermis is of a deep brown color, but this color is due

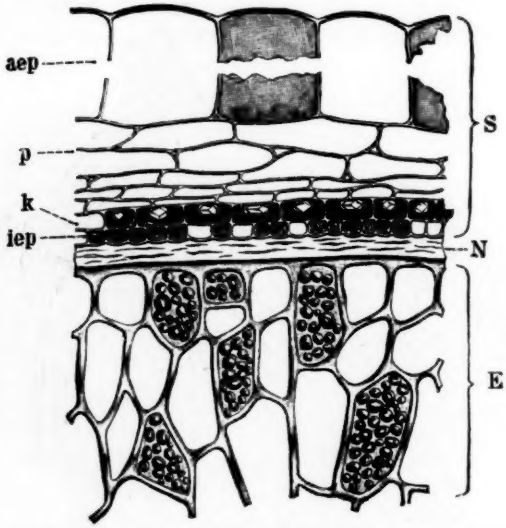

FIG. 18.—Red currant seed in transverse section. S, testa consisting of aep, gelatinous outer epidermis, p, parenchyma (nutritive layer), k, crystal layer, iep, brown layer (inner epidermis); N, hyaline layer (nucellus); E, endosperm. × 300.

to cell contents, not to thickened cell walls. The cells are longitudinally elongated, varying in length up to 0·15 millimeter and in width from 0·004 to 0·009. Both this layer and the crystal layer are readily separated from the endosperm by soaking in dilute potash and scraping.

Nucellar Layer (*Fig. 18*, N).—A cross section of the seed shows a cellulose band about 0·01 millimeter thick between the testa and the endosperm, consisting of the obliterated cells of the nucellus.

The Endosperm (*Figs. 18* and *20*, E) fills the larger part of the seed cavity. The cells are mostly elongated in the outer layers,

but isodiametric in the inner portion and contain aleurone grains and fat. In the outer cells the walls are of even thickness (about 0·002 millimeter), but in the centre of the seed they frequently have knotty thickenings (*Fig. 19*).

Microscopic Examination of Red Currant Preserves.—Cells of the endocarp are the most conspicuous and characteristic elements of currant preserves. Fragments of the epidermis and floral parts are also evident, but are of less value in identification. The outer gelatinous coat of the seed is destroyed by cooking, but the crystal layer and the inner epidermis retain their original form and may be identified in surface mounts prepared by warming the seed in dilute

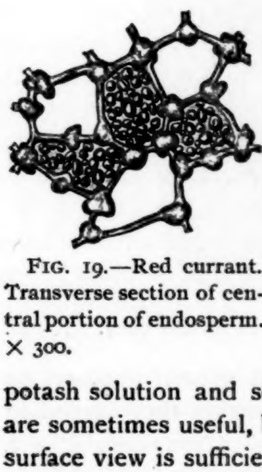

FIG. 19.—Red currant. Transverse section of central portion of endosperm. × 300.

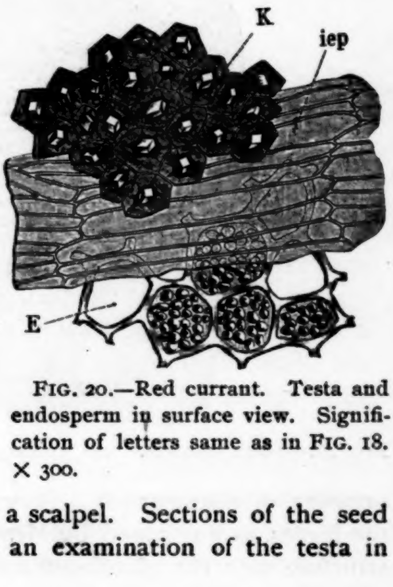

FIG. 20.—Red currant. Testa and endosperm in surface view. Signification of letters same as in FIG. 18. × 300.

potash solution and scraping with a scalpel. Sections of the seed are sometimes useful, but as a rule an examination of the testa in surface view is sufficient.

THE BLACK CURRANT (*Ribes nigrum* L.).

This species does not occur native in America, the cultivated varieties of both Europe and America being derived entirely from European stock.

Macroscopic Structure.—In external appearance the fruit of this species is distinguished from the red currant by its black color and by the longer floral parts. The seeds are somewhat smaller and more numerous (about fifteen in each berry) than in the red varieties.

The calyx is about 7 millimeters long, and the lobes are reflexed.

On the outer surfaces and on the ends of the inner surfaces, the lobes are clothed with numerous hairs; but the throat is smooth, as are also the petals and the styles. The latter is entire for at least three-fourths its length, but two-lobed at the end.

Histology.—Meyen[1] noted the glands on the black currant leaf in 1837. Lampe[2] studied the pericarp but did not describe the glands.

The cells of the *Epicarp* (*Fig. 21*, epi) are beaded and of about the same size as in the red currant. Here and there may be seen the bright yellow disk-shaped glands which are often 0·17 millimeter

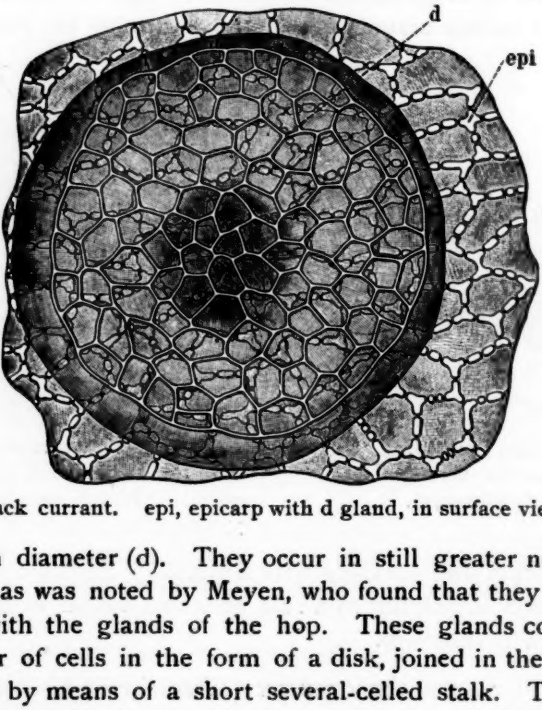

FIG. 21.—Black currant. epi, epicarp with d gland, in surface view. × 160.

or more in diameter (d). They occur in still greater numbers on the leaves, as was noted by Meyen, who found that they agreed in structure with the glands of the hop. These glands consist of a single layer of cells in the form of a disk, joined in the middle to the epicarp by means of a short several-celled stalk. The yellow oily secretion to which the plant owes its characteristic odor and flavor is contained in the reservoir formed by the separation of the outer cuticle from the cells.

The *Mesocarp*, *Endocarp*, and *Seed* have the same general structure as the same parts of the red currant.

Under the microscope the *Calyx Hairs* have the same appearance

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[1] Secretionsorgane d. Pflanzen. Berlin, 1837.

[2] *Loc. cit.*, p. 295.

as those on the epicarp of the raspberry. They are crooked, blunt-pointed, thin-walled, and vary in length up to 0·6 millimeter.

Microscopic Examination of Black Currant Preserves.—Black currant preserves, jams, etc., have a red-black color, and the characteristic spicy flavor of the fresh fruit. They are further distinguished from similar products made from red currants by the glands on the epidermis, the longer floral parts, the hairs on the outer surface of the calyx and the smaller seeds.

The mesocarp, endocarp and seed tissues of the red and black currant are the same in structure.

[*To be continued.*]

PHARMACEUTICAL MEETING.

The opening meeting of the series of pharmaceutical meetings of the Philadelphia College of Pharmacy for 1904-05 was held Tuesday afternoon, October 18th, with Prof. Joseph P. Remington, Dean of the Faculty, in the chair. The attendance and general interest manifested in this first meeting, as well as the nature of the subjects considered, gave promise that the present series of meetings will be as interesting as any held heretofore.

M. I. Wilbert was the first speaker introduced, and exhibited a series of some fifty-odd lantern slides, illustrative of the early history of medicine and pharmacy in this country, the two callings being at first identified as one.

Not the least interesting of Mr. Wilbert's remarks were those relating to the part which Benjamin Franklin took in the development of pharmacy as a separate branch of medicine. And it is especially noteworthy that the great philosopher was the first to make record of the history of pharmacy in this country. In his pamphlet, an "Account of the Pennsylvania Hospital," he gave the first authentic record of the appointment of a pharmacist to dispense prescriptions. To Dr. John Morgan belongs the credit of having been the first physician in this country to write prescriptions, and of the physicians in the eighteenth century there were only two others who followed his example, namely, Drs. Abraham Chovet and John Jones. Reference was made to Dr. Thomas Mitchill, who was chairman of the first Pharmacopœial Revision Convention, this being held in Washington City in 1820, and who also called the next meeting, which was held in New York in 1830. Among the

new features introduced into the New York edition of the Pharmacopœia were doses, and the physical and physiological properties of the substances contained therein.

In 1821 the honorary degree of Master in Pharmacy was conferred by the University of Pennsylvania on a number of pharmacists, this being the first time that a pharmaceutic degree was granted in this country. The University was located in Ninth Street below Market, and a picture of the building as it then appeared was exhibited by Mr. Wilbert. This was followed by a view of the celebrated Carpenters' Hall, where the meeting for organizing the Philadelphia College of Pharmacy was held in 1821, and one of the German Society's building, where the first lectures of the College of Apothecaries were given.

Among the other pictures may be mentioned those of the store and works of Dr. Dyott, America's first cutter; one of Dr. George W. Carpenter, the first to engage in the manufacture of proprietary medicines in this country, and also noted as having first introduced a proprietary sarsaparilla preparation; and one of Elias Durand's store at Sixth and Chestnut Streets, where soda-water was first dispensed, and where the first soda-water fountain was installed as a feature of drug-store equipment. Another notable personage of this time was Dr. Samuel Thomson, the founder of eclecticism, and who appears from his portrait to have been a man of more polish than he is sometimes reputed to have been. The last picture shown was that of the store of Edward Parrish, at the corner of Eighth and Arch Streets, in the room above which the Alumni Association of the Philadelphia College of Pharmacy was organized.

In this connection Mr. Wilbert presented to the Publication Committee a portrait of Daniel B. Smith, who was the first chairman of this committee, the first editor of the AMERICAN JOURNAL OF PHARMACY, the first secretary of the College and its president for twenty-five years.

Dr. Henry Leffmann, the well-known chemist and authority on organic analysis, followed with a paper on "Food Preservatives" (see page 503).

Dr. R. G. Eccles, of Brooklyn, presented a paper on a similar subject, namely, "How Food Preservatives Affect the Public Health" (see page 506).

In discussing this subject, M. I. Wilbert said:

The most important factor in connection with food preservatives

appears to have been overlooked. This is the general practice of adding preservatives to food materials that have undergone partial decomposition or, in other words, practically arresting the decomposition of food at a stage where the generated poison does not manifest itself by the accompanying odor of the more complete decomposition.

When the preservative is one that is readily detected by our sense of taste or smell, this constitutes, in a measure, a warning that will tend to place us on our guard; when, on the other hand, the added material does not manifest itself to our sense of taste or smell, but does prevent the further decomposition in the food material that would attract our attention, we have the really dangerous combination of generated poison (ptomaines) plus the added food preservative, and no marked indication of the presence of either.

All that the gentlemen quoted by Dr. Eccles, or any other rational individual, can and does ask is that all perishable food material containing added food preservatives be properly labeled, so that the buyer may have proper warning and act accordingly. If a manufacturer or dealer wishes to establish a trade in perfectly wholesome food, preserved by the addition of any well-known preservative, he may do so at the present time by properly branding his product.

Charles H. LaWall took exception to some of the statements made by Dr. Eccles in his paper. He stated that while it was easy to prove the harmful action of the ptomaines, it was not easy to prove the deleterious effects of the constant use of preservatives which were undoubtedly harmful. The object of the advocates of the addition of preservatives is not as altruistic as Dr. Eccles would have us believe, but is for the purpose of making money by marketing products which could not otherwise be sold.

Mr. LaWall said that the Doctor was not consistent in saying that he would only allow the use of preservatives in certain products and under certain conditions, for if all the Doctor's statements are to be believed, it would be better to have a law compelling the use of preservatives in every article of food or drink.

The Doctor also confused the terms decay and fermentation, as preservatives are added to prevent the latter just as much as the former, and the latter are usually dependent upon enzymes for their action.

The statements regarding hydrochloric acid were extremely illogical, as the amount which is present in gastric juice, 0·2 per cent., is not sufficient to preserve from decay, while an excess of HCl in the gastric juice *does* prevent the action of the enzymes.

Those who had not followed the subject closely would be misled, too, by the Doctor's statements regarding salicylic acid in fruits, as if the acid exists there at all, it is in such slight proportions as to be undetectable by the ordinary methods of analysis when testing for preservatives, and is, therefore, a negligible factor.

Prof. Henry Kraemer said that it seemed to him that physicians were in a measure responsible for the confusion that exists in regard to poisons, as they have failed as yet to define what constitutes a poison. (See this JOURNAL, 1898, p. 527.) He thought that the question was one which concerned the medical profession especially, and should be referred to the American Physiological Association or to a committee of research workers on animal physiology.

He said that many kinds of food could be preserved by simply heating, but that commercial conditions were such that manufacturers put their goods up in cans and bottles in quantities which were most economical to the consumer. If the product is not consumed at once, and is in the hands of the poorer class of people, who have no ice-boxes or other means of preventing decomposition, they are liable, especially in hot weather, to lose part of the article, which they can ill afford, unless a preservative has been used. Professor Kraemer then read an abstract from a recent number of the *Chemist and Druggist* (October 8, 1904), on the conviction of a dealer in Belfast who had used 7·2 grains of salicylic acid per pint in ginger wine, which conviction the writer said was surprising in face of the evidence and previous decisions respecting the use of preservatives in wine. Dr. T. B. Bradshaw, lecturer on clinical medicine at the University of Liverpool, was quoted by the writer as having expressed a rational view of the matter, as follows:

"The alleged drawback of preservatives, that they open the way for dirty and fraudulent practices, and make it difficult to teach care and cleanliness to the poor, can have but little weight if it be true, as I maintain, that they keep food in a condition fit for consumption, which would otherwise have to be thrown away. In a community in which probably 25 per cent. of the people are too

poor to purchase enough food to maintain themselves in full health the importance of avoiding all unnecessary waste is obvious. Even if we grant all that has been alleged against preservatives, their strongest opponents have not attempted to show that the use of them has ever raised the death-rate to 39 per 1,000. I do not hold up the use of preservatives in food as a council of perfection. If our slums were abolished and our people were all wise and prosperous, there would be less use for them, though I believe that in the case of temperance beverages they will always be needed to supply the place of the alcohol which keeps intoxicating drinks from going bad. What I do maintain is that in the conditions under which the poor live in our large cities their food is certain to undergo rapid decomposition in hot weather unless preservatives are employed."

The following provisional program has been arranged for the next meeting, which will be held on November 15th:

"The True Scope of Scientific, or so-called Expert Testimony in Trials Involving Pharmacological Questions." By Dr. S. Solis Cohen.

"A Record of Several Toxicological Investigations." By George M. Beringer, Ph.M.

"Some Recent Advances in Pharmacy and Medicine." By M. I. Wilbert, Ph.M.

FLORENCE YAPLE,
Secretary pro tem.

PHILADELPHIA COLLEGE OF PHARMACY.

MINUTES OF THE SEMI-ANNUAL MEETING.

The semi-annual meeting of the members of the Philadelphia College of Pharmacy was held September 26, 1904, in the Library, at 4 o'clock, the President, Howard B. French, presiding. Nineteen members were present. The minutes of the quarterly meeting held June 27th were read and approved. The minutes of the Board of Trustees for June 7th were read by the Registrar, Jacob S. Beetem, and approved. The Historical Committee, by its Chairman, George M. Beringer, reported progress. The Committee on Nominations, C. B. Lowe, Chairman, presented the list of proposed nominations for Trustees, which was ordered entered on the minutes. A letter was read from Mr. H. Bell, informing the College of the serious illness of First Vice-President, William J. Jenks, when, on motion of Mr. Boring, the Secretary was directed to convey to Mr. Jenks the sympathy of the members, with the hope that he would soon be restored to his usual health.

The President announced the death of our fellow-members, William Weightman, who became a member in 1856; and Doctor Julian Fajans, who

became a member in 1875. Referred to the Committee on Necrology to prepare suitable memoirs for publication in the JOURNAL.

Prof. Henry Kraemer read a letter from Dr. F. B. Power, Director of the Wellcome Research Laboratories, and an honorary member of this College, stating that he desired to present the papers and other documents relative to the proceedings of the International Congress for the Unification of Potent Remedies, held at Brussels in 1902. Dr. Power's thoughtfulness in making the Philadelphia College of Pharmacy the repository for these papers was commented upon, and the thanks of the College were voted him.

A communication was received from Prof. Edward Kremers, Chairman of the Historical Committee of the American Pharmaceutical Association, requesting a file of the announcements of the College, together with any documents touching upon the history of the College, also reprints with reference to JOURNAL articles, giving page and author. The subject was referred to the Historical Committee of the College.

Action on the proposed amendment to the by-laws, laid over from the last meeting (see AMERICAN JOURNAL OF PHARMACY, August, page 400) was then considered. The amendment was discussed by Messrs. Beringer, French, Kraemer, Wiegand, Meyer, England, Kraus and Ellis, when Mr. Beringer proposed an addition to the present by-law, Article VIII, Section 3, as a substitute, which was adopted. The by-law, as amended, will read : "All applications for membership shall be referred to a standing committee of five, of which the Treasurer and Secretary of the College shall be members, whose duty it shall be to investigate the moral character and professional standing of said applicants, and report at the next stated meeting of either the College or Board of Trustees, to which the application has been presented. It shall also be the duty of this committee to consider the ways of increasing the membership, and to report annually at the meeting in June on the status of the membership of the College."

The election for three Trustees was then proceeded with ; Messrs. McIntyre and Kraus were appointed tellers, who, after a ballot, announced that Edward M. Boring, Richard M. Shoemaker and Charles Leedom had been unanimously re-elected for the ensuing three years.

ABSTRACT FROM MINUTES OF BOARD OF TRUSTEES (HELD JUNE 7, 1904).

The Committee on Library reported a number of accessions, among them eighty-four volumes from the library of the late Charles F. Zeller, presented to the College by his father. The Committee on Accounts and Audit reported that the books of the Treasurer, Registrar and Committee on Publication had been audited and found correct.

The Committee on Announcement reported that they had contracted for the printing of the Announcements for the year 1904, and that they would be promptly distributed.

Walter E. Brown, Lorne E. Hastings, George A. Siegrist and Harry A. Spangler were elected to active membership. Wilbur Le Roy Lafean, Walter Eugene Dittmeyer and Charles B. Fricke were elected to associate membership.

C. A. WEIDEMANN, M.D.,
Secretary.

SPECIAL MEETING.

OCTOBER 24, 1904.

A special meeting of the members of the Philadelphia College of Pharmacy was held at 3.30 o'clock. The President, Howard B. French, in the chair. The call for the meeting was read:

Mr. Howard B. French, President.

DEAR SIR:—We respectfully request that you call a special meeting of the members of the College to take appropriate action upon the decease of First Vice-President William J. Jenks, Ph.M.

Signed, THOS. S. WIEGAND,
GEORGE M. BERINGER,
JACOB S. BEETEM.

Mr. French, in feeling language, alluded to the great loss the College had sustained in the death of Mr. Jenks. He felt it as a personal loss, as he had enjoyed his friendship for many years, and it was his privilege to meet with him often to discuss College affairs. Mr. Jenks graduated from the College in 1842, and was elected to membership in 1846, and a few months afterwards was elected a member of the Board of Trustees, serving the College for fifty-eight years with rare fidelity as trustee, secretary and vice-president.

At the call of the chair for remarks, Mr. Charles W. Hancock, a former apprentice, alluded to the uniform kindness he had received from Mr. Jenks. He recalled some of the early incidents of their association together, and said that he had enjoyed his friendship ever since.

Dr. Lowe said it was a pleasure to come in contact with Mr. Jenks. He was a courtly gentleman of the old school—genial and upright, and all who knew him felt that he was the grand old man of the College.

Wallace Procter said that he had known Mr. Jenks for many years, and all agreed that one of his great characteristics was his kindliness of heart, which was especially shown towards struggling students, and that he always wanted to help them to the full extent of his ability.

Dr. Mattison alluded to Mr. Jenks as having a unique personality, as being a strictly Christian gentleman and a great loss to the College.

Mr. James T. Shinn alluded to the remarkable courage displayed by Mr. Jenks amid severe financial losses.

Professor Remington said we have lost one of the best friends the College has ever had. Mr. Jenks was a strong man, and all could see he loved his fellow-men. His beaming face, his kindly attitude, the particularly tender side for students, his warm friendship, all was evidence of the kind Christian gentleman. He also alluded to his long service on the Committee on Examinations, his devotion to the best interests of the College, and said that he will be sadly missed.

Mr. Thos. S. Wiegand alluded to the young manhood of Mr. Jenks in the store of Smith & Hodgson, and how he had corrected typographical errors in some of the early editions of the United States Dispensatory, for which he had received the thanks of the late Dr. George B. Wood.

Mr. Evan T. Ellis could confirm the remarks that had been made. He had been associated with Mr. Jenks in connection with the drug trade and in social and church circles for the past fifty years. His vigor of mind and body had astonished him.

Mr. M. N. Kline said if any one could make a word-picture of the characteristics of Mr. Jenks, it would make a book of considerable size. He was a notable example of cheeriness under all conditions. Such reverses as he had endured would make most of us blue, morose or, at least, impatient. Even great affliction, the loss of his wife, did not seem to affect his cheerful manner. He was an example worthy of all emulation—a marked example of cheerfulness.

Mr. George M. Beringer spoke of his having recently received an autobiographical sketch of Mr. Jenks—written since his illness began. It would make an article for future publication in the AMERICAN JOURNAL OF PHARMACY. He further remarked that the cheery smile of Mr. Jenks had been an inspiration to him in his student days and ever since.

Mr. William J. Miller spoke of the genial, happy disposition of Mr. Jenks during all of the forty-nine years he had known him. He wished to testify to the cheerful courteousness of the man, and confirm all that had been said by others.

A letter was read from Mr. Edwin M. Boring regretting his inability to be present to show, with others, his respect to the memory of Mr. Jenks. The lesson of his life to us is that we should cultivate the genial side of our lives, that we may have hosts of friends and few enemies.

Professor Remington then offered the following resolutions, which, being seconded by Dr. Mattison, were unanimously adopted:

WHEREAS, The Philadelphia College of Pharmacy, by the death, on October 21, 1904, of First Vice-President William J. Jenks, has suffered an irreparable loss; therefore be it

Resolved, That his long and devoted service of fifty-eight years as trustee and officer in this College completes a record of fidelity and earnest work which merits the gratitude of every member.

Resolved, That this College places on record its deep sense and sincere appreciation of the character of our deceased officer. Honest and true, urbane and unselfish, he won the hearts not only of his contemporaries, but of every student who came under the influence and charm of his personality.

Resolved, That these resolutions be entered upon the minutes, and that an engrossed copy be sent to the family of our deceased officer, and that we extend to them our heartfelt sympathy in their bereavement.

There was a large number of the members of the College present, among whom were (some failing to record their names):

George M. Beringer, Robert T. Berry, Jacob S. Beetem, E. Fullerton Cook, Charles H. Clark, Evan T. Ellis, Joseph W. England, Howard B. French, Charles W. Hancock, Mahlon N. Kline, Henry Kraemer, William E. Krewson, C. B. Lowe, Charles H. LaWall, William McIntyre, A. W. Miller, William J. Miller, R. V. Mattison, O. W. Osterlund, Wallace Procter, H. N. Rittenhouse, J. P. Remington, W. A. Rumsey, Samuel P. Sadtler, H. L. Stiles, James T. Shinn, F. P. Stroup, Thomas S Wiegand and C. A. Weidemann.

C. A. WEIDEMANN, M.D.,
Secretary.